REMARKS

Upon entry of the amendment, claims 1, 27, 28, 36, 38, 39, 42, 48, 51 and 54-58 are pending. Claims 19-23, 33-35, 38, 41, 44, 47, 50 and 53 (directed to a nonelected invention) have been canceled without prejudice. Claims 36 and 39 have been cancelled. The cancelled subject matter appears in claim 1 as previously amended. Claims 1, 56 and 58 have been amended to more clearly delineate the claimed invention.

Support for the amendatory changes is found within the specification, particularly on page 10 starting at line 25, and on page 14 at line 29.

It is again respectfully requested that the request for drawing corrections be held in abeyance until the application is otherwise in a condition for allowance.

The withdrawal of the rejection(s) under 35 U.S.C. § 103 is noted with appreciation.

Claims 1, 26-28, 36, 39, 42, 45, 48, 51, 54-58 are rejected under 35 USC 112, first paragraph, because the specification does not enable the any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with the rejected claims. Applicants traverse.

Claim 1 is directed to a method for modifying the carbohydrate composition of a plant or plant organ. The process entails growing a transformed transgenic plant containing a vector or recombinant expression construct encoding a microbial endo-glucanase operably linked to a regulatory or leader sequence. The construct causes the glucanase expression and thereby the glucanase modification of the carbohydrate composition contained in a cellular compartment or organelle of the plant. The regulatory sequence is one that directs expression of said enzyme-encoding nucleotide sequence at a selected stage of development or maturity of the transgenic plant or plant organ; one that comprises a 35S CaMV promoter; or one that directs tissue-specific expression of said enzyme-encoding nucleotide sequence in a plant. The leader targets the expressed endo-glucanase to the carbohydrate material in a desired compartment or organelle.

Claim 54 is directed to a recombinant DNA expression cassette characterized as having a regulatory sequence operably linked to a nucleotide sequence encoding an endo-microbial glucanase. The regulatory sequence is one that directs expression of said enzyme-encoding nucleotide sequence at a selected stage of development or maturity of the transgenic plant or

plant organ, one that comprises a 35S CaMV promoter; and one that directs tissue-specific expression of said enzyme-encoding nucleotide sequence in a plant.

Claim 56 is directed to a stably transformed, transgenic plant that contains a stably integrated gene encoding a microbial endo-glucanase which results from the introduction of the claimed an expression described in claim 54.

Claim 58 is directed to a stably transformed, transgenic plant or plant organ having a cellular compartment or organelle containing a microbial endo-glucanase modified carbohydrate composition. The plant is further described as being made by the method described in claim 1.

Not all of the comments set forth in the Official Action are equally applicable to these distinct claim types. For example, the relevance of the Examiner's comments to the expression cassette (claim 54) and the vector containing the cassette is not seen since they having nothing to do with vector design and construction.

Modification of the microbial endoglucanases to form variants ("muteins") or the nucleotide sequences that encode Variants is not required by the claims. The interaction of glucanases with starch or other plant carbohydrates to form various hydrolyzates is not novel nor is the use of related glucanase pairs to form specific types of glucan hydrolyzates (note class 435/94+). What the disclosed invention and the claims are directed to is the formation of modified plant carbohydrates in cellar compartments and/or organelles. How this is to be done is taught in the specification.

Representative glucanases are set forth on page 6, starting at line 20. Useful targeting leader sequences are set forth starting at line 25 on page 10. Useful regulatory sequences are set forth starting on line 24 of page 9. Suitable plants are illustrated on page 8 starting at line 25.

The examples, especially Examples 3-5, 7-8, and 11-12 illustrate the operation of the invention in a variety of plants, e g. potato, tomato, tobacco, using various approaches, e.g. agrobacterium, tuber-specific expression construct, and enzymatic modification of carbohydrates at various sites, e.g. leaves, roots and fruit. The specific types of glucanase used is not critical. Their selection is based on the desired end. The known carbohydrase action patterns(s) would aid in the specific selection as would the degree and type branching present in the carbohydrate material. These are the type of selections which would involve at best routine experimentation.

The delivery of the enzymes to a desired site merely involves the selection of a known regulatory element or targeting leader. The elements for doing this are known. The specification, especially the examples, illustrate the operation of the invention. Following, these teachings using conventional materials is not seen to involve undue experimentation, especially as to the claims as amended. The stated object is merely to modify carbohydrate composition of the plant. This does not necessarily require the maintenance of a trait. The nature of the modification, e.g. presence of oligo- and/or monosaccharides, is described as is its monitoring using conventional assays.

The points raised by the Examiner in the Official Action do not address the sufficiency of the teachings provided within the specification or their sufficiency in the context of the invention as now claimed.

The Examiner's main objection appears to be that expression of the genes to obtain desired plant phenotypes is unpredictable. The Examiner further argues that the instant disclosure fails to teach the factors which are essential for successfully expressing a glucanase gene of microbial origin. The Examiner assumes that the expression of nonplant genes in plants always requires modifications of the microbial coding sequence. Applicants have shown in the specification that for the expression of two microbial enzymes, α-amylase and glucoamylase, no modification of the coding sequence was needed (see Example 2 and Example 9). The claims are limited to microbial endoglucanases and successful events.

Applicants note that the Examiner seems to have overlooked many of the arguments presented in our response of 24 May 1999 and the supplemental response of the same date and has maintained his objection concerning non-enablement as outlined in the Office action of 24 November 1998 since they are not addressed. From the Office action of 24 November 1998, the Examiner maintains that the specification "does not reasonably provide enablement for all methods of modifying carbohydrate of any transgenic plants that express any DNA sequence of any primary enzyme of interest capable of degrading polysaccharides." However, enablement for all methods of modifying carbohydrates is not necessary as the application does not concern all methods of modification, but simply the method covered by claim 1 as amended. Similarly, claim 1 concerns a microbial endoglucanase and not, as suggested by the Examiner, any primary

enzyme capable of degrading polysaccharides. Applicants disagree with the Examiner's finding of non-enablement and believe that the specification enables the claims as amended.

Turning now to the Examiner's comments outlined on page 3 of the Office action. Applicants disagree with the Examiner's suggestion that the existence of genes of microbial origin that need modification in the coding sequence for plant expression renders predictability at a level that would discourage the skilled practitioner. Applicants again remind the Examiner that the present application details two examples (Example 2 and Example 9) which illustrate that the expression of two microbial enzymes, α-amylase and glucoamylase, does not require modification of the coding sequence. In view that the present claims do not cover the situation where modification of a coding sequence is required, Applicants wholly disagree with the Examiner's requirement that Applicants need to provide details concerning methods for the mutagenesis, modification and alteration of a coding sequence.

In situations where modification of a coding sequence is required, standard techniques would be employed which are well known to those skilled in the relevant art. Applicants acknowledge that genes of microbial origin that require modification of the coding sequence exist, but many genes of microbial origin do not require such modification for efficient plant expression, such genes being readily apparent to persons skilled in the art. Therefore, predictability cannot be said to be at a level that would discourage the skilled practitioner.

Furthermore, Applicants disagree with the Examiner's suggestion that obtaining a transgenic plant with a desirable phenotype is unpredictable. The transforming of plants with genes of microbial origin render the process of obtaining a desirable trait more predictable than the transforming of plants with plant-derived genes. This issue of unpredictability is therefore only applicable to the transforming of plants with plant-derived genes. The unpredictability is due to the close relationship of the plant from which the gene was obtained and the plant into which the gene has been transformed. Interference with the endogenous gene already present in the host plant can therefore be expected. This apparently is not the case when using microbial genes.

Furthermore, the Examiner has objected that no guidance is given concerning methodology used to select the nucleotide or sub-nucleotide sequences of interest. As discussed

in the response to the previous Office action, the methods used to select the sequences of interest involve merely routine experimentation.

Withdrawal of the rejection is respectfully requested.

CONCLUSION

Applicants have amended the claims to obviate the rejections raised under 35 U.S.C. § 112. Applicants have further demonstrated that methods for introducing a transgene into a cassava plant and the subsequent regeneration of cassava plants from the transformed cassava plant cells were known in the art at the time of the present invention. Such methods could be used in the present invention without undue experimentation. Accordingly, Applicants respectfully request that the Examiner reconsider the rejections of the claims, that he withdraw same, and that he pass the application to issue. If, in the Examiner's opinion, a telephonic interview would expedite the prosecution of this case, he is respectfully requested to contact Applicants undersigned representative at (202) 887-1678.

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952**. However, the Assistant Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

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Respectfully submitted,

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